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thus recorded on the plate. Their intensity indications at 40 spectrum positions are reduced by aid of a special slide rule plotting machine.

A pair of silver disk pyrheliometers is read simultaneously with each spectro-bolographic determination. Measurements of humidity, temperature, and barometric pressure accompany the bolometric observations. Also a pyranometer is employed to determine the total sky radiation.

The young men find pleasant companions at the great copper mine at Chuquicamata. At present they are boarding with a Chilean family at Calama, but as both are good cooks they may wish to board themselves. The railway and the river both pass the town of Calama, so that there is no such desert isolation as might be feared. To the east are the Andes Mountains. The peaks in that neighborhood rise to 16,000 or 17,000 feet. Some are volcanic but none of these are very near.

We hope the work will be continued for several years at least, and that nearly daily observations may be obtained. The application of the results to meteorology is something which may prove to have great possibilities. To exploit them we must first possess a long and nearly unbroken series of solar radiation observations.

MAROON—A RECURRENT MUTATION IN DROSOPHILA[1]

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Communicated August 23, 1918

The recessive eye-color 'maroon' was one of the early mutations in Drosophila (found March 13, 1912). This eye-color was found in a stock culture of wild flies, and was at first supposed to be a new appearance of the recessive mutation 'purple' discovered about a month earlier. Genetic tests (crosses between the two lines, etc.) showed that the new color was not the old purple, but was a new mutation almost identical with purple in appearance but entirely independent in origin and inheritance. This was the first of our now numerous cases of eye-color 'mimics,' in which two distinct genes produce practically the same somatic effect.

During the six months following the discovery of purple and maroon there were thirteen recorded appearances or 'purple' eye colors, which constituted our most striking 'mutating period' of 'epidemic of mutation.' Of these new 'purples,' tests showed that the first, fifth, sixth, and thirteenth were maroon, while the rest were true purple. A study of the pedigrees showed that these maroons had come from two independent occurrences of the maroon mutation, while the true purples likewise came from at least two separate acts of mutation. Maroon has reappeared independently on two subsequent occasions, so that this particular mutative process has occurred at least four times. The same property of specific recurrent mutation has since been found to be characteristic of several other loci, of which notch, vermilion, rudimentary, and cut are the most striking examples.

At this time (April, 1912) pink was the only mutation known to be in the third chromosome (by definition) so that the F_2 results from the cross of maroon to pink constituted the only test as to whether maroon also is in the third chromosome. Maroon differs enough from pink in its characteristics so that the separation of the two forms could be accurate for about 85% of the individuals. The F_1 flies from the cross were wild-type (two non-allelomorphic recessives), and the F_2 flies were 485 wild-type: 215 maroon-like: 183 pink-like: 0 maroon pink.

It was expected that the flies which were homozygous for both maroon and pink would be as much lighter than pink as maroon is lighter than the wild-type, since this was the usual type of relationship. No flies lighter than pink were found, but it was uncertain whether this meant that the double recessive was actually absent because of strong linkage (no crossing over), or that the double form was present but indistinguishable from pink or from maroon. That the double form should be present, but not lighter than pink, would mean that maroon and pink are 'non-modifiers' of each other. Subsequent work has shown that 'non-modification' is the usual relation between the different pinks that have arisen.

That the apparent absence of the maroon pink class was a real absence due to linkage was soon proved: Tests, by means of F_2 and back cross results, of the linkage relations between maroon and the second chromosome mutant "arc" showed that these two genes assort with complete independence. The above tests showed that the locus of maroon was probably not in the second chromosome, and was therefore probably in the third chromosome. Meanwhile the body color ebony had arisen and had been shown to be linked to pink (Sturtevant, '13).[2] Since there could be no question of failure of identification of the double recessive maroon ebony the next step was to show that maroon is linked to ebony. The F_2 of the cross of maroon by ebony gave a 2 : 1 : 1 : 0 linkage ratio, which we had just learned to explain as the result of 'no crossing over in the male' (Morgan, '12).[3] The F_2 from the maroon by pink cross was thus proved to have been a 2 : 1 : 1 : 0 ratio, and was in fact the first such linkage result obtained for the third chromosome.

The location within the third chromosome of the gene for maroon was made easy and direct by the discovery and location of two excellent III chromosome dominants, 'dichaete' and 'hairless.' The locus of dichaete is quite near the left end of the third chromosome (at about 11.0) while that of hairless is near the middle (at about 32.0). The back cross tests showed that the locus of maroon is to the right of dichaete by about 4.2 units, or is at a position of 15.2 (11.0 + 4.2) when referred to the locus of sepia as the zero point. With hairless, maroon gave 21.2% of crossing over, which corresponds to the location of maroon between dichaete and hairless.

It was found that the chromosome in which the third independent mutation to maroon had occurred was carrying two other mutant genes: One of these, 'dwarf,' is a recessive that reduces the size of flies to only about half that of normal sibs; it also sterilizes females homozygous for it. The locus of dwarf is within a unit to the right of that of maroon. The other gene causes no observable somatic difference, but profoundly affects the process of crossing over in third chromosome in definite regions and by definite amounts. A distinct new system of cross-over values corresponds to the heterozygous and still another to the homozygous condition for the gene. A comparison of the behavior and effects of this gene with that of the already known genetic varition called 'C_{III}' showed that they were probably identical mutations. There was found to be 5.9% of crossing over between dichaete and maroon in females heterozygous for C_{III}, and 6.6% when females were homozygous for C_{III}. In the region near dichaete there is, as these values show, no great difference between the homozygous and heterozygous C_{III} conditions.

[1] A full account of maroon with the detailed data on which the various statements of this paper are based will appear as a section of a publicatian by the Carnegie Institution of Washington.

[2] Sturtevant, *Science, New York*, N. S., **36**, 1913, (990-992).

[3] Morgan, *Ibid.*, **36**, 1912, (718–720).